HUDSON RIVER RAIL ROAD

REPORT

ON THE

LOCATION OF THE LINE

BETWEEN

FISHKILL AND ALBANY;

WITH

General Remarks

ON THE

PROSPECTS OF THE ROAD.

BY

JOHN B. JERVIS, *Chief Engineer.*

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REPORT.

OFFICE OF THE HUDSON RIVER RAILROAD COMPANY,
ENGINEER DEPARTMENT,
NEW-YORK, 12th January, 1848.

To the Board of Directors of the Hudson River Railroad Company:

Gentlemen—I have the honor of presenting a report on the question of the location of the line of road from

FISHKILL TO GREENBUSH.

Examinations and surveys have been diligently prosecuted by Mr. Clark, the locating engineer, and he has submitted a detailed report with estimates on two routes. In preparing the lines for each route, surveys have necessarily been run over a great extent of country, in order to find the most favorable line for each. In the original survey of Mr. Morgan, the point of divergence from the river was at Fishkill, rising gradually, and as it approached Wappinger's creek it followed the eastern slope of the valley, passing near Houstonville, and crossing the creek east of the falls. The line then inclined westward, intersecting the old post road, and continuing near it until it reached the eastern part of Poughkeepsie. This line was found to be so unfavorable that a new point of divergence was taken at Wappinger's creek, and a route found, which passed Poughkeepsie, about half-way between the above line and the river, and intersected it about two miles north of Poughkeepsie. This portion of the line was found about one mile shorter, and much less expensive than the original or eastern line, and therefore it was decided to adopt it for this portion of the interior route. As the maps, submitted herewith, will show the line better than any written description, they are referred to for information on this point.

The river route generally follows along or near the shore of the river. At Poughkeepsie, Staatsburgh and Barrytown it passes back from the river, in order to avoid interfering with docks, at the first and last place, and a sharp bend in the river at the other. In these departures the grade rises from 20 to 30 feet above that on the immediate shore of the river. The grade at Albany was taken at 22 feet above low water in the river, and gradually declined, keeping above the influence of the freshets, until the point was reached where the freshets of the river do not raise the water above flood tides; from this point the usual level above the river was taken.

The comparative result of the estimates has been different from what was generally expected. After diligent surveys the best line that could be found for the interior route from Fishkill to a short distance north of Staatsburgh, is so expensive as to have but little superiority over the river route.

From near Staatsburgh to Hudson the general character of the interior route is highly favorable, offering a very easy line to grade, comparing very advantageously with the river line opposite. The line continues favorable from Hudson to about six miles north of Kinderhook village; but from this point to near Albany it is of a very expensive character, so much so that it raises the estimate between Hudson

and Albany about $100,000 above that of the river route on the corresponding section.

The main difficulties on the interior route, it will be seen, occur in ascending from the river to the table land. At the north end it passes a series of deep ravines and clay ridges. The table land could have been reached with a much less expensive line, if a grade of thirty feet to the mile had been adopted; but this was regarded as incompatible with the great object to be secured.

The following tables show the degree and amount of curvature and straight line on each route, and the inclination of the several lines, or gradients of the road, with the elevation and depression on each route:

SUMMARY OF CURVES AND STRAIGHT LINES.

RIVER ROUTE.

Number of Curves.	Length of Curve of same deflection, in miles.	Radii in Feet.	Deflection in Degrees.	Total Deflection in Degrees.
4	0.348	2062	41° 45'	
4	1.490	2475	191°	
78	15.418	3094	1480° 05'	
1	0.664	3375	33°	
7	1.523	3713	124° 10'	
30	6.716	4125	495° 29'	
10	2.976	4641	194°	
5	1.093	5305	51° 20'	
14	2.363	6188	113° 30'	
1	0.184	7426	18°	
7	1.850	9282	60° 20'	
				2802° 39'

Total curved line,......... 34.625
" Straight line........ 48.375

" Length in miles,..... 83.000

SUMMARY OF CURVES AND STRAIGHT LINES.

INTERIOR ROUTE.

Number of Curves.	Length of Curve of same Deflection, miles.	Radii in Feet.	Deflection in Degrees.	Total Deflection.
3	0.818	2062	116°	
2	0.184	2475	24°	
34	8.578	3094	834° 18'	
3	1.289	3713	105°	
23	3.347	4125	252° 36'	
4	1.462	4641	95° 20'	
27	10.094	6188	528° 15'	
5	1.808	9282	59°	
				2014° 29'

Total Curved line......... 27.580
" Straight line........ 54.885

" Length in miles...... 82.465

RIVER ROUTE.

Table of Grades and Level Lines between Fishkill Landing and Greenbush.

Distance in miles.	Inclination per mile in feet.	Ascent in feet.	Descent in feet.	Total Ascent and Descent.
49.312	Level.			
9.204	0.271	2.50		2.50
5.993	0.500	3.00		3.00
1.759	1.136	2.00		2.00
2.454	2.445	6.00		6.00
1.000	5.00	5.00		5.00
2.250		22.50		
3.007			30.	
2.006		20.		
2.505 12,774 miles.	10.00		25.	127.50
1,503		15.		
1.503			15.	
0.504	15	7.50		7.50
83.000		83.50	70.00	153.50

INTERIOR ROUTE.

Table of Grades and Level Lines between Fishkill Landing and Greenbush.

Distance in miles.	Inclination per mile in feet.	Ascent in feet.	Descent in feet.	Total Ascent and Descent.
8.888				
5.276	From 3 to 4	8.80	11	19.80
1.012	" 6 to 7		7	7
940	" 7 to 8		7.04	7.04
1.553	" 8 to 9	8.00	5	13.00
2.454	" 10	24.54		24.54
634	" 10 to 11		6.87	6.87
1.636	" 11 ft.		18	18
2.515	" 11 to 12	22.78	6	28.78
4.970	" 12 to 13	62.28		62.28
1.963	" 13 to 14		27	27
7.056	" 14 to 15		102.63	102.63
1.411	" 15 to 16	22		22
13.023	" 16 to 17	159.93	57.18	217.11
28.807	" 17	222.28	267.35	489.63
0.327	" 17.040	5.90		5.90
82.465		536.51	515.07	1051.58

From the tables of curves, which show the linear arrangement, it appears that the Interior route has six and a half miles more straight line, and seven hundred and eighty-eight degrees less curvature, than the River route; the minimum and maximum radius being the same on each route. The length or distance from Fishkill Landing to Greenbush being on the

Interior route..82.465 miles
River " ....83.000 "

The river line is longest by...................... 0.535

The lines may be extended from half to three-fourths of a mile further north, depending upon the point that may be selected for a termination; but assuming it may be half a mile, the distances will be respectively on the

Interior route ....82.965 miles.
River " ....83.500 "

The tables of gradients, or planes, show the maximum grade of the

River route to be ....10 feet per mile,

(excepting half a mile extending south from the Poughkeepsie depot, which has a grade of 15 feet per mile; but as it occurs where the trains must stop, it is not regarded as of any practical importance.)

Interior route ....17 feet per mile.

The total rise and fall is on the

Interior route .... 1051.58 feet.
River " .... 153.50 "

The highest summit above the river grade is

On the Interior route ....218 feet.
On the River route .... 30 "

In linear arrangement the Interior route is, say, half a mile shorter, and has 6½ miles more of straight line. The curves on both lines, with a small exception, are on large radii, being from 3094 feet to 9282 feet, and admit of being traversed at high velocity. In this respect the lines may both be considered as good, the preference being with the Interior, both as to directness and distance. In the more important matter of gradients, or planes of the road, the River route is materially superior.

No estimate has been made for land required for the road on either route. Experience having shown that the real value of land, when taken for such purposes, has little to do with the question, provided two things are settled, namely, the line of the road, and the determination to proceed with its construction.

In connection with this subject it may be remarked, that the land required for the Interior route, for the greater part, passes through a fine agricultural country, and, to a greater or less extent, unavoidably traverses cultivated fields. The River line occupies mainly the rough and uneven ground along the shore of the river, doing little real damage, except as it disturbs buildings at the villages. In some places the wharves will require to be extended, and this is provided for in the estimates. To a very great extent the construction of the Road will improve the appearance of the shore; rough points will be smoothed off, the irregular indentations of the bays be hidden and a regularity and symmetry imparted to the outline of the shore; thus by a combination of the works of nature and of art adding to the interest, grandeur and beauty of the whole. However strongly this may now be objected to by some, it is confidently believed that before two years shall have passed after the completion of the road, none will be found willing to have the road removed.

To some extent conditional contracts for land have been made on both routes, which will doubtless be submitted by the Land Committee, and the Board will judge as to the influence of land damages on this question of location.

The estimated cost is as follows:—

River Route,		
Grading, including masonry and bridging	$2,079,159	
Extending wharves	30,000	
Fencing	82,200	
	2,191,359	
Add for contingencies and superintendence at 10 per cent	219,135	
		$2,410,494
Carried forward		$2,410,494

Brought forward $2.410,494

Interior Route,

Grading, including masonry and bridging	$1,616,465	
Fencing	85,200	
	1,701,665	
Add for contingencies and superintendence at 10 per cent	170,166	
		$1,871,831
Interior less than River route		$538,663

The estimate is made for grading for a double track to Poughkeepsie on both routes, and a single track from Poughkeepsie to Albany—the masonry and bridges for a double track throughout.

The estimate would not exceed the above, on either route, more than $200,000, to provide for a double track throughout. The difference will be less in proportion to total cost on the River route, in consequence of the river walling, which is a heavy item, and will be the same for a single as for a double track.

Having presented a statement of the gradients of the two routes, it is now proposed to investigate their comparative advantages in the working of the road. In doing this, it will be the object to present the subject in a manner as free as practicable from technicalities, and if it do not appear clothed in a strict professional form, it is believed the Board will, not the less, be able to understand and appreciate it. As the passenger and freight trade will be affected somewhat differently, it appears proper to consider them separately. In doing this, the engines and their power, and the resistances they must overcome, will be especially the subjects of discussion.

ENGINES FOR PASSENGER TRAINS.

The medium by which a Locomotive exerts its power on the load, is the adhesion of what are termed its driving wheels to the rails. If this adhesion be not sufficient, the wheels will slip on the rails, and, though the engine may turn the wheels, the load will not move forward. In any event, therefore, provision must be made for so much adhesion in the driving wheels as will be sufficient to enable the engine to move with the load it is intended to transport. The capacity of the boiler to generate steam determines the actual power of the engine. This power being settled, the load the engine can transport, will be in a ratio varying inversely with the velocity with which it is to be moved; but the medium (adhesion) by which this power is transmitted will be in direct proportion, not to the velocity, but to the load.

This may be illustrated by supposing an Engine capable of moving a load of 100 tons at the rate of 15 miles per hour. Now the velocity may be increased so that the engine can only carry 50 tons, though working up to her full capacity of generating steam; but the weight of the load being reduced one half, the amount of adhesion in the engine necessary to set it in motion is also reduced one half. The adhesion of the driving wheels, therefore, may be reduced as the velocity is increased, the power of the engine remaining the same.

It is important to keep distinctly in view, that the actual power of an engine is determined by its capacity to generate steam, while the adhesion required to apply this power to the load, will be in proportion to the load, and the load will vary according to the velocity with which it is moved.

A passenger train is required to move more rapidly than a freight train, and, consequently, requires *less* adhesion in its driving wheels. The practical consideration of this question of adhesion depends materially on the character of the road

and the circumstances of its passenger trade. If heavy gradients occur occasionally on the route, or heavy loads are to be carried, that do not require great speed, it is necessary to provide more adhesion to enable the engine to exert its power at a reduced velocity.

Passenger Engines in this country are generally made with two pairs of driving wheels, a practice which I consider to have arisen from the frequency of heavy grades and the necessity of carrying heavy loads, at a corresponding diminution of velocity. This may do very well where no competion exists, and a moderate velocity will afford sufficient accommodation to control the trade ; but it is not applicable where high velocity and the greatest economy are required in working the road.

The advantages of one pair of driving wheels over two pairs are—First ; less number of working parts in the machine, by which the risk of accident and the cost of repairs are diminished. Second : The machine being more simple works more effectively ; and Third : By substituting a simple pair of bearing wheels for one pair of large driving wheels, from one and a half to two tons are saved in the weight of the engine, while its power is not reduced. These are considerations of great importance in an engine, designed to run at high velocity.

In England it is believed to be the uniform practice, on roads on which a high velocity is maintained, to use engines with one pair of driving wheels, for their fast trains.

Perhaps there is no road that, from its gradient and the importance of running at high speed, is better adapted to, or more urgently demands the use of engines with one pair of driving wheels for its passenger trade, than the one under consideration. The investigation will, therefore, proceed on the basis of engines with one pair of driving wheels, and they will be assumed to be capable of working up to their adhesion, at the speed with which it is intended to run.

The adhesion of a driving wheel will be in a ratio of the weight with which it bears upon the rail. This ratio will be affected by the condition of the rail. When dry, or washed by a heavy rain, the rail is regarded as in its best state for adhesion; and, when slightly wet by dew, or mist, in its least favourable state, if we except white frost and snow, which at times, nearly destroy it. In a fair state of the rails this adhesion is equal to 1-6 the insistent weight, and 1-8 is regarded as a safe basis for the usual, or ordinary condition of the rails. For a passenger business 1-10 is considered a proper ratio for general calculation ; allowing for a larger range in the condition of the rails, and at the same time providing for the occasional occurrence of an extra load, which it may be necessary to attach to the engine.

The question has been dwelt on more at length, on account, not only, of its importance, but because the views entained are somewhat at variance with the general practice in this country.

Before proceeding to calculations of the load an engine will move, the principal sources of resistance will be briefly noticed. They are

First.—That arising from the friction of the cars. It is usually estimated that 8 1-2 lbs. is a power sufficient to draw one ton, of 2240 lbs. on a level. This has been reduced to 6 lbs. on the best carriages on English roads. It is probable that a similar reduction will in time be effected in this country, but as we must commence with cars, not differing materially from those now in use, it is best not to anticipate improvements, so far as to make them the basis of computation at this time. Eight and a half pounds, therefore, will be taken as the basis for friction.

Second.—Air offers a resistance that is very small at low velocities ; but as velosity is increased it becomes important. This is approximately determined, by ascertaining the area of that part of the train which is exposed, when in motion, to

the impact of the air, and the velocity of its motion. With a train of five passenger cars moving at the rate of 35 miles per hour, this resistance would require a power of about 400 pounds to overcome it ; and if, in addition to this, the train should meet a head wind, blowing at the rate of ten miles per hour, the resistance would be increased to about 660 pounds. Should such a current of wind, however, blow in the direction of the train's motion, the resistance would be reduced to about 200 pounds. It therefore appears, that, while the train moves at the same rate, this resistance may be very different, varying according to the force and direction of the wind. The speed of the train, however, must be maintained in all cases, and power must be at command to meet the ordinary circumstances of this resistance. At the same time it would not be economical to provide at all times power sufficient to meet the resistance of extraordinary head winds—it would be best in such cases, when a heavy train is to be moved, to use an extra engine. These remarks are sufficient to shown the importance of this element of resistance, and such provision should be made for it, as appears to be demanded for the proper conduct of a passenger train. A wind blowing at the rate of 10 miles per hour, is a very common occurrence, and, as it must be against the train in one direction, it would hardly be prudent to provide less power than sufficient to meet this amount of atmospheric resistance.

Third.—The resistance from gravitation in ascending an inclined road, which will vary according to the angle of ascent. If the resistance from friction be taken at 8 1-2 pounds per ton, of 2240 lbs., the resistance from gravitation will be essentially the same in amount, in ascending an inclination of 20 feet per mile ; and in proportion for any other inclination. It therefore, appears, that to draw a load up an ascent of 20 feet per mile requires double the power needed to draw it on a level. It must not be inferred from this, that an engine will draw half the useful load up such ascent, that it would on a level ; for, in moving up the ascent, the resistance from the gravitation of the engine and tender must be deducted from the power that was available on the level to carry useful load, and the difference in effect, caused by this deduction, will be in the ratio which the weight of the engine and tender bears to the useful load carried ; consequently it will be greater for a train moving at high velocity, than for one moving at a low velocity.

The first and second elements of resistance, viz, friction of carriages and the impact of the air, occur to a train moving on a level ; the resistance arising from gravitation, in addition to these occurs on an ascending plane.

The weight of engine assumed for the following computation is—

16 tons, with 7 tons (15,680 lbs) on one pair of driving wheels.

Weight of Tender, 14 tons.

The ton used in these calculations is 2,240 lbs.

Adhesion 1-10 the insistent weight on drivers.

Friction of cars $8\frac{1}{2}$ lbs. per ton.

Resistance of air, 650 lbs., due to a velocity of 35 miles per hour, against headwind of 10 miles per hour.

The gross load includes the cars and their load, and is *exclusive of the engine and tender*.

Then, we have

$$\frac{15,680}{10} = 1,568 \text{ lbs, tractile power of the engine.}$$

$$\text{and } \frac{1,568-650}{8.5} - 14 \text{ (tender)} = 94 \text{ tons, gross load on a level.}$$

To determine what portion of this the engine will carry up an ascent, we must first deduct the resistance arising from the gravitation of the engine—which will be found (having assumed the resistance from friction of cars as equal to an ascent of 20 feet per mile) by taking such fraction of the weight of the engine and tender as will be in the same ratio to its full weight as the inclination of the plane is to an ascent of 20 feet per mile: and deduct the same from the gross load on a level, before stated; the remainder must be divided by a number that will express the resistance from both friction and gravitation of cars.

We have then for an ascending plane of

$$10 \text{ feet per mile} = \frac{94-(8+7)}{1.5} = 52.66 \text{ tons gross load.}$$

$$17 \text{ feet per mile} = \frac{94-(13.6+11.9)}{1.85} = 37.03 \text{ tons gross load.}$$

For the several planes embraced in the preceding computations, the gross load due to the adhesion, as assumed, appears to be

On a level	94.00 tons.
On ascent of 10 feet per mile	52.66 "
On ascent of 17 feet per mile	37.03 "

It is assumed (and fully believed) that the engine may be made to generate steam, sufficient to move the loads above stated, on the respective planes, at a velocity of 35 miles per hour, and make average time, including stops, of 32 miles per hour; at this speed the trip between New York and Albany would be performed in 4½ hours.

If the road were constructed uniformly on either of the planes embraced in the above computations, the load expressed would be the measure of useful effect on each. But this is not the case on either of the two routes under consideration, as has been shown in the table of grades before given. It is therefore necessary to see how these results will be modified by the different planes, and their lengths on either route.

The ratio of adhesion has been taken at 1-10, and if the velocity of the engine be reduced, a corresponding increase of load may be taken, provided the adhesion be sufficient to transmit the power to the load. It has been stated that the maximum adhesion is 1.6 the insistent weight, and for short distances it may safely be taken at 1-8, if not 1-7; but let it be 1-8, which will be an increase of 25 per cent. Now, if the velocity be reduced to 25 miles per hour, the resistance from air will be reduced, according to the basis of the calculation of that resistance, 250 pounds. If this power be applied to overcome the friction and gravitation of additional load, it would be equal to the traction of 30 per cent of the gross load in this case, and we may, therefore, safely add 1-3 to the load, if this reduction in velocity is permitted. By this reduction in velocity a loss of time is caused, half of which may be regained by an increase of speed on the descending planes, when the power of the engine will be aided by the same amount of gravitation, which was overcome in the ascent. This question will be further modified by the intervening planes of lighter ascent and descent, and those that are level.

Not to go into too much detail, it may suffice to assume that all the grades on the *Interior line* that are below 14 feet per mile, will permit the engine to maintain an average speed of 35 miles per hour; and those above this, being for the most part 16 and 17 feet per mile, will cause some retardation. For the *River line*, all that are at and under five feet per mile will also allow the maintenance of an average speed of 35

miles per hour, and all over this being 10 feet per mile, will cause some retardation.—The time required to perform one mile at the rate of 25 miles per hour is 686-1000 of a minute greater than at the rat e of 35 miles per hour, and if half this is regained by increase of speed on the descending planes, the loss of time per mile of heavy plane in the ascent is equal to 343-1000 of a minute. Multiplying the number of miles in each plane by this fraction, will give the total loss of time caused by the proposed increase of load, and is

For the Interior Line—

25-312 miles a .343 = 8.682 minutes

For the River Line—

6,625 miles a .343 = 2.272 "

Difference in favor of River Line....6.410 "

A grade of half a mile in length, of 15 feet per mile, occurs on the River Line, which has been included in the length of road having a grade of 10 feet per mile, but has not otherwise been considered, for the reason, that it terminates at the point designed for a depot at Poughkeepsie, where the speed would necessarily be reduced, for the purpose of stopping the train, and because its length is not sufficient to produce any practical impediment to the progress of the train.

From the computation above stated it appears that the loss of time by the Interior, as compared with the River Line, will be about 6½ minutes; but this loss, in consequence of the extra length of the River Line, about half a mile, will be reduced to, say, 5½ minutes. On the other hand, the River Line, being mainly a level, would have some advantage over the undulating plans of the Interior Line. It does not, however, appear important to enter into furthe details.

It is necessary now to determine the number of passengers that may be transported, or that will make up the load of the Engine.

For through passengers, with the usual allowance for baggage, the following estimate has been prepared:

A car capable of accommodating 50 passengers is estimated to weigh when empty	7 tons
50 passengers at 150 lbs each	3.34
Baggage, at an average of 40 lbs with twice and a half the weight in car to carry it, is equal to 140 lbs per passenger, and 50x140 gives for gross load of baggage and car	3.12
Total for 50 Passengers	13.46

equal to 3.64 passengers per ton of gross load.

Consequently we have on the several planes above investigated, as follows (adding ⅓ on the ground before stated) viz:

	Passengers.
On a level	94x3.64=342
" an ascent of 10 feet per mile	$\left\{52.66+\frac{52.66}{3}\right\}\times 3.64=255$
" " 17 " "	$\left\{37.03+\frac{37.03}{3}\right\}\times 3.64=180$

The trains would probably average ⅔ of a full load, and the number of passengers then would be

On a level	228
" ascent of 10 feet per mile	170
" " 17 " "	120

If the running velocity be reduced to 30 miles per hour, and an average of 26

miles per hour, including stops, as for a way train, the load may be increased about $\frac{1}{3}$ of the above, and the average would be,

On a level..304 passengers.
" an ascent of 10 feet per mile...........................227 "
" " 17 " " ....160 "

The great difference of the loads on the several planes arises from the causes before mentioned and the large amount of power required to overcome the resistance of the air, which, being nearly the same on all the planes, must first be deducted from the power; thus reducing the useful effect, and varying the ratio of the weight of engine and tender to the total load transported.

To increase the load on the 17 feet ascent to that above given for a 10 feet ascent, it would not be necessary to increase the power of the engine in the proportion above stated. The resistance from air would be essentially the same, and it would only require sufficient additional power to overcome the resistance from friction and gravitation, which would be about 25 per cent. This, however, does not affect the correctness of the above comparison; it only shows that for a larger engine the ratio of useful effect would compare somewhat more favorably for the heavy planes: for the larger engine, if on a 10 feet plane, at the same velocity, would carry a corresponding increase of load, leaving out of view one element of resistance common to both.

The class of engine assumed in the preceding computations is one that is regarded as well adapted to high velocity. It may be found expedient to adopt a larger class; but for the work it may do, this will probably operate as economically as any other, and, therefore, the comparison is a good one for the several planes.

Such an engine may be run at an expense of forty cents per mile, and the repairs of cars, road and stations, and all other expenses, will be fully provided for at forty cents more, making the total expense, per mile run, eighty cents. To use a larger class of engines will increase the expense of repairs, both of engines and road, and require a corresponding increase of fuel. The addition of twenty-five per cent. to the weight and power of the engine, is estimated to add ten cents per mile to the expenses for power. The data from which this result has been obtained are not yet clearly settled, as it is not known what the comparative influence of heavy and light wheels is on the cost of repairs of both engine and road. The question is regarded, however, in its application to high velocities, as quite important, and experience may show it to be greater than provided for above. As the planes will extend a controlling influence over the whole road, it appears that the expense of a train carrying the same number of passengers by the interior route will be $14.20-100 more than by the River route.

The average number of passengers, as before stated, for a train moving at 35 miles per hour, on the River line, is 170. The cost of transporting them will be as follows:

On the River Line..........................$115 20
" " Interior................................ 129 40

170 passengers at $1 50 = $255.

Receipts over expenses:

On the River Line...........................$139 80
" " Interior Line.......................... 125 60

The cost of transportation per passenger at speed of 35 miles per hour, is

By River Line.......................... 67 8-10 cents.
By Interior Line....................... 76 1-10 "

Difference in favor of River Line, 8 3-10 cents.

In a large passenger train, at a speed of about 22 miles per hour, or so as to make the time between New-York and Albany $6\frac{1}{2}$ hours, an engine with two pairs of driving wheels, and weighing 20 tons, would be able to transport

On the River Line........................500 passengers.
" " Interior Line....................375 "

The cost would be the same in either case, except the difference in the additional cars for the larger number, which is estimated at 10 cents for each passenger, or \$13 50 on 135, which is the excess in the number of passengers.

The cost is estimated for the train—

River Line, at..................................\$140 00
Interior Line, at.............................. 126 50

Cost per passenger:

River Line..................................28 cents.
Interior Line..............................33 7-10 "

If the load be reduced 1-5th for an average, the cost will be on the—

River Line....................35 cents per passenger.
Interior Line ....42 1-10 " " "

The preceeding computations show two important features in the economy of a passenger traffic, viz: That arising from large trains, or a full load, as compared with a partial load; and that arising from a moderate velocity, as compared with a high velocity, a speed of 32 miles average velocity costing about double that of 22 miles.

ENGINES FOR FREIGHT TRAINS.

These generally travel at the rate of about 12 miles per hour. At this speed the resistance from air is not of much moment, and is not usually taken into account; this calculation will not be made so close, in regard to power and resistance, as to render it necessary to do so. The adhesion will be taken at 1-8th the insistent weight, which is about 1-3d less than will be available in a good state of the rails. As the speed is slow, two pairs of driving wheels are necessary, and it will be easy to give the engine power to work up to this adhesion. Engines for freight trains have been made for six and eight driving wheels, but for general use those with two pairs, or four driving wheels, are preferred.

The data for the calculation of their performance will be as follows:

Weight of Engine, 20 tons.

Weight on 4 drawing wheels, 14 tons, or 31,360 pounds.

Adhesion 1-8th the insistent weight on drivers.

Tender, 14 tons.

Traction per ton of gross load, $8\frac{1}{2}$ pounds.

Then, $\frac{31360}{8} = 3920$ pounds the tractile power of the engine.

$\frac{3920}{8\frac{1}{2}} - 14 = 447.17$ tons, the gross load on a level, exclusive of engine and tender.

The load that can be taken up an

$$\text{Ascent of ten feet per mile} = \frac{447.17 - (10 + 7)}{1.5} = 286.78 \text{ tons.}$$

$$\text{Ascent of 17 feet per mile} = \frac{447.17 - (17 + 11.9)}{1.85} = 226.09 \text{ tons.}$$

The freight a car will carry should be six-tenths of the car and freight. The amount of freight, therefore, comprised in the above calculated loads, will be:

On a level..................447.17 $\times$ .6 = 268.30 tons.
Ascent 10 feet per mile.......286.78 $\times$ .6 = 172.06 "
" 17 " " ....226.09 $\times$ .6 = 135.65 "

The cost of running the train (exclusive of depot expenses) is estimated for engine men, (including driver, firemen, conductor and brakemen,) fuel, oil, and maintenance of way and engine, at 50 cents per mile run, or for 144 miles, $72; for cars, including maintenance of the same, and their share of maintenance of way, 35 cents per ton of freight on the whole trip of 144 miles.

The cost of transportation will be for an ascent of 10 feet per mile—

Engine, &c., as above	$72 00	
172 tons freight, at 35 cents	60 20	
		$132 20

For an ascent of 17 feet per mile—

Engine, &c., as above	$72 00	
135 tons freight, at 35 cents	47 25	
		$119 25

The cost per ton transported, hence, is

On the River Line........................ $\frac{132.20}{172}$ = 76.86 cts.

Do Interior Line..................... $\frac{119.25}{135}$ = 88.33 cts.

Difference in favor of the River Line say 12 cts. per ton.

In order to present a more comprehensive view of the comparative ultimate economy of these two routes, it is necessary to ascertain the amount of business that will be done, and that will be influenced by this question: All the through business and a large portion of the way business above Fishkill will be affected by it. It is, obviously, proper that any estimate that is made should look forward to a period some years subsequent to the opening of the road throughout. Not less than five years (and ten would be more near the mark) should be taken to allow a fair development of the business of the road, which will go on, thereafter, increasing with the growth of the country. Keeping this in view, not less than 500,000 passengers and 100,000 tons of freight may be taken as the amount of business that will be affected annually by this question, and according to the results arrived at above, this would be done at a reduction of cost on the River Line, as compared with the Interior, as follows:—

500,000 passengers at 8 cts	$40,000
100,000 tons freight at 12 cts	12,000
Total	$52,000

These amounts of traffic must be regarded as moderate, in view of the prospects of the road.

It is estimated that the River Line would be more expensive to maintain, on account of exposure to the ice, and the wash of the river.

This, however, would be counterbalanced to some extent by the slides and settlement of the heavy clay cuttings and embankments that must be encountered on the Interior route. The River route, especially that portion exposed to the action of the river, is for the most part of hard and rocky materials, well adapted to resist the influences referred to. So far as fuel or other material for the use of the road may be required from the river market, the River route will be most advantageous. In view of the relative exposure that will cause extra expense in maintenance and the facilities for conducting the business of the road on the two routes, it is considered that the River route will be in the aggregate the most expensive, probably to the amount of ten thousand dollars per annum. This is a proper item to be deducted from the superior economy above shown in favor of the River route in regard to running expenses and will reduce the saving to Forty-two Thousand Dollars per annum.

If, therefore, the amount of annual business before assumed be well founded, the River route will be equal as an investment at the additional outlay in first cost of $600,000.

The estimated excess in cost has been shown to be $538,663. This difference in cost compared with the economy in conducting the business of transportation, leaves the question of route to be settled mainly by the relative prospects of business on the two. In examining this question it is proposed to confine the enquiry to those items that are or may be considered peculiar to each. The general or through trade is supposed to have been provided for in the calculations before presented; but it is considered proper to remark that it is believed the amount assumed is much below what it will be within ten years of the time of the completion of the road,

and was taken rather than place this question on a more remote period of its trade. Both routes reach Poughkeepsie on lines that leave no important considerations in favor of one over the other.

After leaving this place, the interior route, intersects no village or city on the river, until it reaches Hudson, which it passes about one mile from the river. It passes through or near the villages on the old post road, ranging from one to near four miles from the river. From Hudson the line inclines easterly from the river, passing several factories and running about one and a half miles westerly from the village of Kinderhook, where it is about three miles from the river; thence inclining towards the river the line traverses about six mile of cultivated country, and about ten miles very little cultivated, when it comes out into the valley of the river, about three miles from Albany. After passing Kinderhook there is no village on the line, or nearer than those on the river, which on the east side, are small between Hudson and Albany.

Between Poughkeepsie and Hudson, this line traverses a fine agricultural district, that extends from the east bank of the Hudson river, to ten, and in some cases fifteen miles in width, where the country becomes broken and hilly, and much less valuable for agriculture. There is nothing worthy of note as manufactures, or mechanical facilities for manufactures in this district. The trading towns are small, dividing the commerce of the country with the small villages on the river where the heavy business is done. Between Hudson and Kinderhook village, there are several large manufactories, at Columbiaville, Print works, Staatsville, and Stuyvesant Falls. If concentrated, they would form a very respectable manufacturing town. Some of them are so situated that they would be as well accommodated by one line, as the other, but generally the inland route would best accommodate them. From Hudson to about six miles North of the Kinderhook village, the line traverses a fine agricultural district.

The interior route for the most part runs from two to four,

and some times(by the travelled roads) five miles from the river. This circumstance will give it the control of the passenger business of the district through which it passes, at higher rates of fare, than could be obtained from the same, if they were to go to the line on the river, where a choice could be made between the Railroad and steamboat conveyance. The saving in cartage over ordinary roads, would be an inducement to send a larger amount of freight on the Railroad, than would be sent if the property were transported to the river, where navigation would come in direct competition with the Railroad.

These remarks are applicable only during the season of navigation; when the river is closed by ice, the Railroad will have no competitor.

The river route following the shore, and passing directly, or near by the steamboat landings, must come in direct competition with the river navigation, for all its business during the season when the river is not obstructed by ice. If it should not be able to sustain this competition successfully, then it is clear the interior route would be the best, and it would be advisable to carry it still farther from the river than it has been run.

If it be admitted the Railroad will successfully compete with steamboats, still it would be at some reduction in profit, and a larger amount of trade must be secured on the river route to produce the same amount of income.

The villages on the east shore of the river between Poughkeepsie and Hudson and also between Hudson and Albany are small. On the opposite side of the river, the villages are much more important. Of the latter, Kingston and Rondout are situated at the termination of the Delaware and Hudson Canal, and more shipping is employed at Rondout, than at any other place, between New York and Albany.

Saugerties is a large and flourishing manufacturing village. Cattskill is among the most important towns on the river. Athens is a considerable village opposite Hudson. Coxackie

is the most important village between Hudson and Albany, and New Baltimore and Coeymans, larger than any village on the east side between the same places except Stuyvesant landing. By an inspection of the map of the State it will be seen that the trade and travelling of a larger extent of country, concentrates and passes through the villages on the West side, than through those on the East side, if we except Poughkeepsie and Hudson.

This arises from the greater facility of diversion on the East, than there is on the West side of the river.

If the road were constructed on the interior route it would be less able to compete for the travelling from the river villages than for the travelling of the interior villages, if the river route should be adopted; for the passengers from the villages on the river would have the boats at hand, when to take the railroad on the interior route they must travel from one to five miles on ordinary roads to reach it; whereas travellers from the interior, if the road was on the river route, must do no more to reach the railroad than would be necessary to reach the boats. Travellers from the west side of the river could not be expected to cross and take conveyance to the interior route to any great extent. The road constructed on the interior route would, no doubt, cut off the great mass of travelling on and east of it, that now goes to the river, and it would lose the greatest part of that on the immediate bank of the river, more particularly of the river villages; and it would lose nearly all the travelling from the west side.

If the road should be constructed on the river route, it would be able to compete at even terms with the boats on the river, for the travelling that would come from the interior line; for, as before observed, they must come to the railroad, in order to take the boats, and then the railroad and the boats would be offered for their choice. For all the business on the east side of the river the railroad would then have a fair competition with the boats. To obtain business from the west side the railroad must offer such facilities as will induce passengers to

cross by a ferry in order to enjoy them. Advancing north from Poughkeepsie the river narrows, and ferries may be easily and cheaply established. They already exist to a considerable extent, and it is confidently believed the advantages the railroad would offer immediately opposite, would lead to the most convenient and cheap accommondation of this sort. Suppose a number of passengers on the west side of the river at Catskill, designing to take the day boat from Albany—the cars are to arrive on the opposite side, already an hour, to an hour and a half in advance, and will reach New York four to five hours in advance of the boat; how many of them would cross a ferry requiring five minutes, and take the cars in preference to waiting for the boat? Certainly every one of them that desired a few hours to transact business in New York and return to Catskill the same evening, and probably the greater part of those who did not design to return the same day. To reverse the direction of travelling, the passenger at New York desires to visit Catskill, and spend a few hours to transact business, or for amusement, and return to New York in the evening, would take the cars of necessity, as the boat would not furnish the means of accomplishing his object. And if he leave New York in the evening, the cars would enable him to reach Catskill about nine o'clock, while the boat would arrive at the uncomfortable hour of one or two o'clock the next morning. This is a practical affair, and may readily be comprehended by any man, at all acquainted with the habits of the travelling community, and there can be no doubt a very large share of travellers from Catskill would prefer crossing a short ferry, and thereby avail themselves of the superior facilities the railroad would furnish. What has been said of passengers to and from Cattskill, will apply to every town on the west side of the river above Poughkeepsie, and leaves no doubt that the way business from the west side of the river, would be very large, if the road was constructed on the river route.

It is believed the freight traffic during the season of navi-

gation would be greater on the interior, than on the river route. For the season of suspended navigation, the river route would command the largest amount of freight, from the increased facility of approach, from the west side of the river.

The increase of traffic from the establishment of manufactures by steam power, would be much greater on the river route, than on theinterior route. Many persons have little faith in the use of steam for such purposes, and will not regard this as of the least importance; but in view of the fact that steam power is now used in the Eastern States to drive two hundred and forty thousand cotton spindles, besides other machinery, it cannot be doubted the highly favorable advantages enjoyed, and to be enjoyed, in the Hudson River valley, will soon induce the establishment of such manufactures.

The coal that finds its way to the shores of Rhode Island and Massachusetts, to drive steam mills, comes directly from the mines into the valley of the Hudson, and may be landed from the canal boats, at the doors of similar establishments on its banks.

The valley of the Hudson receives the traffic of a vast extent of country, which naturally seeks this avenue of communication. The business of the Railroad is to improve this avenue, by affording a more expeditious conveyance in summer, and at all seasons, the means of cheep and expeditious transit. That the road during the season of suspended navigation will control the business of freight and passengers, as before observed, cannot be questioned. If it cannot compete successfully for passengers during the season of navigation, then as before stated, it will be best to adopt the interior route, where a considerable share of business might be obtained, in consequence of its being so far removed from the competition of the river. It therefore appears necessary to a proper understanding of the comparative merits of the two routes, that the question as to the capacity of the Railroad, to compete with boats for passengers, should be examined. The great business of the Railroad in summer must be in passengers, and it is proposed to examine the prospect of its ability to do this business.

If it cannot successfully compete with the boats for the way traffic, it certainly cannot for the through traffic, and in this view the question is essential to the success of the enterprise on any route. It will be considered that the boats on an average, make the trip in ten hours; they sometimes, under favorable circumstances, perform it in seven and a half to eight hours, but the average of fast boats, including landings, do not much, if any, exceed the average above stated. The cars on the Railroad will easily make the trip in five hours. It may be urged that the boats will increase their speed, to which it is a sufficient reply, that the Railroad will possess the means of maintaining a corresponding increase.

The boats, to increase their speed, must be able to resist a dense medium, (water,) while the increased resistance to the cars would be air. The relative power to pass through these elements may be judged of by the speed a man moving in water up to his neck, would make, as compared with the speed he would make by exerting his power, to run through the air. Persons who speak of the increase that will be made in the speed of steamboats, have usually very little idea of the nature of the resistance they must meet, and it may be regarded as a safe basis that the cars can be moved on the Railroad at about double the velocity of boats on the river.*

It has been urged by the opponents of this enterprise, that, though the cars would travel faster than the boats, the latter would be able to transport at so much lower fare, as to command the great bulk of the passengers.

Thers is no doubt that Railroad fare is generally higher than that of steamboats on the Hudson. This may also be said of steamboats on other waters, as compared with the Hudson river boats. The economy of transporting passengers depends materially on the number to be carried, whether by

* The greatest speed attained by Steamboats is believed to be, that made by the Oregon and Vanderbilt last season on a race or trial of speed, from New York to Sing-Sing and back, which was about 23 miles per hour; while many instances have occurred of a speed of 60 miles per hour on railroads, or about three times that of the fastest boats, under the most favorable circumstances.

cars or boats. Were it not that it would too much extend this paper, it might be shown that passengers could be transported at less expense on the Railroad than on boats, considering the numbers that this route will furnish. But it is sufficient to show the practical working of Railroads, and compare the result with what may be depended on for this road. With this view the following tabular statement has been prepared, showing at a glance, the results of business in 1846, on nine different roads in Massachusetts, seven of which terminate in Boston.

Statistics of Rail-roads. Business of 1846.

NAME OF ROAD.	PASSENGERS. Miles run by Trains.	Passengr's per Train.	Receipts pr. m. pr train.	Gross Receipts.	FREIGHT. Miles run by Trains.	Tons per Train.	Receipts pr. m. pr. Train.	Gross Receipts.	Current expenses. Freight and Passengers. Per Mile.	Total.	Velocity per hour—stops included. Pas-sen-g'rs.	Frei ght.	Cost of Road pr. mile.	Divi-dend per Cent.	Length of Road In Miles. Double Track.	Single Track.	Total.	Miscel-laneous Receipts.
			$ cts.	$			$ cts.	$	$ cts.	$	In miles.		$					$
Boston & Lowell	134,633	81	1 38	185,234	52,972	160	3 65	193,836	1 31	212,233	22	12	70,279	8	25.75	1.86	27.61	5,031
" & Providence . .	140,878	62	1 65	230,486	51,786	49	2 14	110,882	88	169,679	25	12	48,806	8	12·25	30.95	43.20	19,497
" & Worcester . .	195,692	65	1 42	279,792	93,008	130	2 79	260,165	98	283,876	22	9	65,710	8	44.62	8.45	53.07	14,754
* " & Eastern	201,626	62	1 53	310,061	33,680	32	1 25	42,270	69	162,804	21	15	53,904	8	16.—	25.20	41.20	15,178
† " & Maine	204,401	46	1 09	223,191	60,738	. . . . .	1 66	119,538	68	179,734	25	8	31,812	6¼	——	82.57	82.57	6,405
" & Fitchburg . .	140,424	44	0 92	128,737	48,173	70	3 15	151,805	63	117,447	20	10	36,259	10	5.11	46.61	51.72	6,101
" & Plymouth, O. C.	63,073	55	1 61	101,857	22,640	13	90	20,403	67	57,230	20	12½	37,758	‡ 5	——	37.	37.	3,449
o Nashua & Lowell	28,515	172	2 07	59,092	18,615	192	3 41	63,613	1 49	70,279	22	12	34,940	o11	13.12	1.19	14.31	4,789
‖ Western R. Road	215,369	99	1 81	389,861	313,259	85	1 49	469,364	78	412,680	22½	10	52,811	6	6.45	148.55	155.	29,891
				1,908,311				1,431,876										
Averages.		76.2	1 50			91.37	2 27		88				48,031	7.80				

* This road leases and runs about 14 miles of road to Portsmouth, for which they own the furniture.

† Total tons carried, 61,599—not reduced to distance carried.

‡ Nett earnings not divided, equal to near 5 per cent.

o Nett earnings not divided, equal to 11 per cent. There appears to have been unusual expenses—repairs of road were $1,742 per mile.

‖ For 11 month's business. Nett earnings for paying dividend and interest 5.66, equal to 6.13 per cent. per annum.

The above statement presents much interesting detail, but it is only intended particularly to remark on those features that bear on the passenger traffic. They do a mixed business of freight and passengers; the latter averaging about sixty per cent. and the former about forty per cent. of the whole, from which it appears the passenger traffic is the most important in the aggregate. The expense of running passenger trains is not kept separate from freight trains, but it is known the latter are considerably more expensive per mile run. The Eastern and Plymouth roads have the smallest freight traffic, and it is seen, their running expenses are twenty cents per mile less than the average of the table.

The average cost of the above Railroads is not materially different from what will be the cost of the Hudson River road with a similar amount of double track and furniture. The total amount of receipts per mile of train run for passengers, averages $1.497, say 150 cents. The average number of passengers is seventy-six. With a traffic made up of this and forty per cent.of freight, the average dividends were seven and eight-tenths per cent. in 1846.

The reports are not yet officially made for 1847, but it is known the dividends have exceeded an average of eight per cent. Considering the great extent of country that concentrates its traffic on the Hudson, and the favorable grades, or planes, this road offers for the transportation of freight, it may safely be assumed that it will derive as much profit from freight, in proportion to its length, as the average of the Railroads, in the above table; and if it can do a passenger business equal to the average that appears above, then it is fair to conclude it will produce equally as great an income as they do, or a dividend of say eight per cent. on its cost.

In order to do this, it must receive an average of one hundred and fifty cents per mile run by passenger trains, and run as many trains, at similar expense for running that is incurred by the average of the above railroads. The planes being much more favorable on the Hudson River Railroad than the

average of those in the table, it may be run at considerably higher speed without increasing the expense. A charge of the average rate of one cent per mile per passenger, would require the average number of one hundred and fifty passengers, to give this road the same success, as those in the table. It therefore remains to ascertain if this average number of one hundred and fifty passengers per train can be obtained.

In general, it may be remarked that the Hudson River Railroad will occupy the greatest thoroughfare for travelling on this continent, and forty trains per day, of the size above required, would not suffice to transport the average number of passengers during the season of navigation. It has a great natural increase that may be expected to go on for many years to come. Increased facilities will still further augment this natural increase, and it may confidently be expected that, within five years from the time the Railroad is in operation its whole length, it will, beyond doubt, require from seventy to eighty such trains per day. But fifteen such trains per day would afford the proposed support to the Railroad. This would leave more business for the boats, at the end of the five years, as above, than they now have. Is it practicable for the Railroad, at a fare of one cent per mile, to secure this amount of buriness? This is the problem to be solved.

Those travellers who from a love of expedition, or have an object to economise time, would no doubt give preference to the Railroad, and this embraces a large class of passengers. But this will appear more clearly by following the practical working of the road.

FIRST.—IN REGARD TO THE MORNING TRAINS.

The boat and the cars are supposed to start at the same hour in the morning, say seven o'clock. The cars will reach Albany at 12 M. The traveller having business requiring several hours to transact at Albany, and desiring to return to New York the same evening, would certainly take the cars,

as his business would be transacted, and himself on his way back by the P. M. train about the time the boat would have reached Albany. This will apply to travellers under similar circumstances to intermediate towns. It will be kept in mind that the boats do not furnish facilities sufficient for travelling to and from Poughkeepsie the same day. A traveller desires to visit the springs; by the cars he will reach Saratoga in good time for dinner, and he will have dined, and be enjoying the benefits of this celebrated watering place, before the boats will have reached Albany. He may dine at Saratoga the next day, return by the evening train to New York, and be at home by ten o'clock, having spent over a day at the Springs, lost no regular rest, with an absence of about thirty-eight hours only from New York. Again, the travellers are going west. (Here it is presumed the roads west of Albany will be put in a condition to realize the progress of railroads.) To a considerable extent these travel by the day line, and would find their taste or convenience very much promoted by the railroad; but the largest portion of the western travellers take the night boat to save time, though they do not like the rest they get on the boats. Some persons, from habit or peculiar temperament, rest very well on steamboats, but it is notorious that the great mass of travellers who take the night boat do so merely to save time, and by so doing make a sacrifice of comfort, which they would be glad to avoid. By taking the morning cars they would reach their destination within a few hours of the time they would have done by taking the boat the evening before. Those for Utica, Syracuse, Auburn, and even Rochester, would be at their destination the evening of the same day.

Travellers from Albany would reach New York by the six o'clock morning trains at eleven o'clock, A. M. and have nearly all the business hours of the day, which would be concluded before the arrival of the boat, and for transactions not requiring more time would be able to take the evening train, and reach Albany by ten o'clock in the evening of the

same day. Way passengers would secure the same advantages. The cars would be much more exact as to time, and would be first offered, as the boat must rapidly fall behind; and it may be regarded as certain, at the fare proposed, that very few would have the philosophy to wait for a chance on the boat. *Instead of its being a question whether the cars could compete with the boats, it is hardly possible the day boats could compete with the cars, especially for first class passengers. The way traffic must enevitably be swept off before their arrival at the way landings. The facilities that will be offered by the cars will not only take the greatest share of the present day travel, but must greatly draw from the night travel.*

SECOND.—IN REGARD TO THE EVENING TRAINS.

Business is generally over, and passengers may be ready to leave New York at five, P. M. The way boats all leave at or before this hour. The cars will then reach Albany by ten o'clock in the evening, and all travellers who do not like a lodging on a steamboat, by taking the cars will be able to lodge at Albany, and may take the cars west from Albany at the same hour the next morning with those who travelled all night in the boats, provided fogs or low water had not prevented the boats from reaching Albany in time for the morning train, in which case the railroad passengers would proceed without them. If expedition be important to the traveller, he would proceed west from Albany at 11 o'clock the same evening he left New York, take an early breakfast at Syracuse, and dine at Buffalo the next day. For the travellers to way stations on the river, especially at or above Poughkeepsie, the hour of reaching their destination by the cars would be so much more desirable than by the boats as to decide the question, with the great mass in favor of the cars. The evening train from Albany will take such passengers as prefer to lodge at home, or at a hotel, and be prepared, by quiet and refreshing sleep, for the next day's business, to a half-waking and disturbed rest on a steamboat, disqualifying them for a

vigorous attention to the duties of the following day. The evening train will take up the way passengers in advance of the boat, and at a more desirable hour for the greater part.

The cars will be run more frequently, and thus better accommodate the travelling public than the boats. All travelling between intermediate places on the route will be far better accommodated by the cars than it can be by the boats.

Thus far the subject has been disscussed with reference to first class passengers, to whom the saving in time secured by the certainty and superior speed of the cars, the superior convenience and comfort of intercourse, as well as the fondness for rapid travelling, would be a sufficient inducement to pay the low fare proposed on the railroad, rather than travel for nothing on the boats. But if it shall appear of any importance for the railroad to run second class trains, in order to meet the competition of the boats for passengers who prefer lower fare to a saving in time, such trains, it has been shown, could be run at half the rate of fare, and make the trip in seven hours, and afford a remunerating profit to the road. At this speed they would always be in advance of the boats, and being provided with comfortable seats, in which there is often a great deficiency on the boats for this class of passengers, and free from delays by fogs, sandbars, and low water, would be much better accommodated by the cars, and make an average saving of two to three hours in time.

The railroads, as before observed, would possess the power of running trains more frequently, taking up the passengers more in detail, and thus extend greater accommodations to the general traffic than could be done by the boats.

What can be done by the steamboats onthe Hudson is well known, and though there is no Rail Road actually constructed, it is equally well known, that it can be constructed and run as proposed. The result is as much a matter of certain calculation in the one case, as in the other. It is reduced to a practical demonstration, and needs only to be looked at by the eye of an every day philosophy. Speed can be attained and will

command passengers at a remunerating fare, and the irrisistible conclusion is—

That the improved facilities the Rail Road will furnish, will enable it, not only to compete successfully with the boats, for the present traffic: but will be the means of greatly augmenting the number of passengers on the route.

Instead of 150 passengers per train, the fast trains may be expected to average 200 passengers, and the slow, or seven hour, trains 350, to 400 per train, during the navigable season. The average daily number of passengers on this route is now estimated at 7000, and the increase the Rail Road will produce, together with the natural increase, will swell this to 10,000, by the time, or very soon after, the Rail Road can be completed throughout. It is certainly a moderate estimate, to assume that the fast trains on the Rail Road will take, of this number, 3000, and the slow trains an equal number, making together 6000, as the daily summer traffic, estimated to average 100 miles each.

The winter traffic, or that during the season of suspended navigation, as before observed, will wholly centre on the Rail Road, both for freight and passengers. The length of this season, with the uncertainty that attends the close and opening of navigation, may be taken at an average of about four months. If the river route be adopted, it will receive, during this season, nearly as much traffic from the interior route, as would come to it, if that route were adopted. Being in the valley of the river, it would draw from the west shore a much larger amount of both freight and passengers, than would seek the interior route from the same quarter.

Reviewing the subject, it appears—

First. That the interior route will be more expensive than was indicated by the original survey.

Second. That the cost of constructing the river route, over that of the interior route, will be less than was anticipated.

Third. That the cost of working the road on the river

route, will be so much less than the cost of working on the interior route, as to neutralize the excess in first cost.

Fourth. That the road will be able to do a successful passenger business in competition with the steamboats,—and by its peculiar and superior facilities, will greatly augment the passenger traffic.

Fifth. That the valley of the river is the natural thoroughfare for the trade and travel of the country on both sides, increasing in extent and importance, as the line advances north to Albany and Troy--and, consequently, the river route, lying directly in the valley, will most effectually secure its present and prospective business, and render the road more extensively useful to the public.

Sixth. That the river route occupying the natural channel of intercourse and trade, will best secure an adequate income to the stockholders, for the outlay they are required to make.

Seventh. That in the aggregate, the river route, presenting the greatest advantages, both to the public and the stockholders, is therefore recommended to be adopted.

It is believed the estimates for the cost of construction and expense of running the road, will be found fully adequate to meet the wants of the work. They have been reached after thorough surveys, investigations and estimates in detail, which cannot vary essentially from the amounts stated.

The report of J. T. Clark, Esq., Locating Engineer, is herewith appended.

In conclusion, it may be remarked, that the examinations connected with this question, have incidentally led to a confirmation of the favorable opinion heretofore entertained of the great usefulness and productiveness of this enterprise. Improvement in the means of social and commercial intercourse have, from time immemorial, been regarded as among the highest evidences of the civilization, intelligence and refinement of society, and it is confidently believed, that the time is not distant, when the benefits of this road will be so developed, that none will be found to disparage a work of art,

that shall justly claim a participation in the production of those efforts, that mark the progress of social, intellectual and moral improvement. To the intercourse of the great thoroughfare on which it is located, as well as to the commercial interest of the city and state, the work is due, as a means of more frequent and rapid transit in summer, and as a remedy for the embarrassment and suspension of communication, now imposed by frost for one-third of the year—and it is demanded as a means of giving to the valley of the Hudson, that increased facility of intercourse in its social and commercial relations, that is called for in the present state of science and civilization.

The thorough surveys and investigations that have been made during the past season, place the enterprise on a well ascertained basis, clearly demonstrating its feasibility and usefulness, and afford high inducements, founded on public advantage and remuneration for the outlay, to stimulate that diligent and intelligent perseverance which may secure an early accomplishment of the great work.

These remarks are made with a profound sense of the responsibility that is involved, and under the firm belief that they are well founded.

Respectfully submitted,

JOHN B. JERVIS,
Chief Engineer.

To

JOHN B. JERVIS, Esqr.,

Chief Engineer, H. R. R. R.

SIR:

HAVING been appointed Locating Engineer of the Northern Division of the Hudson River Railroad, from Fishkill Landing north to Greenbush, I entered immediately upon the duties of said appointment, and commenced field operations at Greenbush on the 24th of May last, with Mr. Edward Martin, as one of my principal assistants. Another party was soon after organized, with Mr. William Jervis as my other principal assistant, and surveys commenced at Fishkill Landing, on the 17th June.

From the commencement of these surveys down to the 15th of November, both parties have been actively engaged in field work. Since that time the available forces of the two parties have been studiously engaged in office work; in the execution of maps and profiles, and calculation of quantities.

I now submit the result of our labors: Two distinct lines have been located, designated as the River Route and Interior Route.

The River Route commences at Fishkill, Upper Landing, and follows the east margin of the Hudson River for most of the distance to Greenbush, terminating at a point about half a mile south of the Boston Railroad Depot in East Albany.

The length of this route is 83 miles from Fishkill Landing to Greenbush.

The Interior Route commences at the same point in Fishkill, and is the same as the River Route for the distance of 5½ miles, when a change of grade is introduced, but no variation of the line takes place for a further distance of 1 mile; at this point the line diverges from the River Route and reaches the table land about 4 miles south from the village of Poughkeepsie, passing through the central part of said village with an elevation of 115 feet above high tide. From Poughkeepsie north, the line passes through the village of Hydepark, a little west of the villages of Rhinebeck, Lower Red-hook, and Upper Red-hook; east of Clermont, crossing the Rulof Johnson Kill, near the "Blue Store," and reaches Hudson at the eastern extremity of the city with an elevation of 163 feet above high tide. Northerly from Hudson it crosses Claverack Creek about half a mile west of Stott's factory, and the Kinderhook Creek near Adam Van Alstine's, which is about two miles westerly from Kinderhook Village. From Kinderhook Creek to Mitche's Kill (six miles) the ground is favorable for a good line and cheap grade, but from Mitche's Kill to Greenbush (12 miles) the country is broken and the grading will be expensive.— This route terminates with the River route at Greenbush, and is 82½ miles in length.

These two lines have been thoroughly revised throughout by re-surveying with care the entire distance of each. Much pains have been taken to obtain correct data on which to predicate an estimate of the cost of construction, and care has been given alike to each of the two lines

In addition to the two revised lines which have been selected for estimates, other lines have been run, and much country explored with a view to improvement, but no routes have been found of advantages sufficient to justify the expense of further surveys on any one of them. Nor have estimates been made of any, except the one first surveyed between Fishkill Landing and Poughkeepsie. This line leaves the Hudson River near the mouth of Wappinger's Creek, and extends easterly along the south slope of the valley for 3½ miles, crossing the creek at the upper falls with an elevation of 45 feet above the bed of the stream. The place of crossing is 1¾ miles above Franklin Dale. Thence it passes through a limestone ridge immediately north of Wappinger's Creek, and traverses a broken country for most of the distance to Poughkeepsie; crossing Main street at Adriance's Furnace, with an elevation of 169 feet above high tide. It unites with the main Interior Line about 2½ miles north of Poughkeepsie.

From Fishkill Landing to thejunction, it is one mile longer than the main Interior line, and much more expensive to grade, as will be seen from the estimate.

Maps and profiles of the two routes are herewith submitted. Also, of the last described line from Fishkill to Poughkeepsie, which is the most easterly route of any. Accompanying this are tables of grades and curves of the two lines.

Table marked A, gives a statement in detail of the grades on the Interior line. Table marked B, gives a summary and concise view of the grades on the same line. Table marked C, gives in detail the different sections of curves and straight lines, the radius of each curve and the total amount of deflection on the Interior line, and table marked D gives a summary and concise view of the curvature on the same line.

In like manner tables are prepared for the River Route marked E, F, G, H.

To insure a greater degree of accuracy, both lines have been divided into sections of suitable length, and an estimate made in detail of each section. A tabular statement is also prepared, giving the length of each section, and the amounts of the different kinds of work, with the prices annexed.

The estimates are for grading for a double track from Fishkill to Poughkeepsie, and single track from Poughkeepsie to Greenbush, with the exception of mechanical work, which is estimated for a double track throughout.

The estimates provide for a road bed on the most liberal scale. In earth excavation, the width of grade line for double track to be 40 feet, and embankment 30 feet. For a single track in earth excavation 30 feet, embankment 20 feet wide on River line, and 16 ft on Interior line. Slopes 2 to 1.

In summing up the estimates we come to the following results :

Cost of grading River Route 83 miles............................	$2,191,359
Cost of grading Interior Route 82½ miles............................	1,701,665
Difference..	$489,694

Without expressing any opinion as to the relative merits of the two routes, I feel much confidence in saying, that whichever route may be selected, the estimates will be found sufficient to construct the work in the most substantial manner, and cover all expenses properly belonging to the grading. Of course, the item of land damages is not included in the estimate; nor the usual allowance of 10 per cent. for contingencies. Nor does the estimate provide for grading depôt grounds, for buildings, or any of the appendages to the road.

Messrs. Martin and Jervis, my two principal assistants, who have had charge of the respective parties, have prosecuted these surveys in the most satisfactory manner, by uniting with skill, continued perseverance, and a course of conduct highly commendable. The young gentlemen composing the parties have also done service to the company and credit to themselves, by performing with cheerfulness and ability the several duties assigned them.

Respectfully,

Your obedient servant,

JOHN T. CLARK.

Poughkeepsie, January 10th, 1848.

Summary of Quantities and Amounts of Southern Division.

RIVER ROUTE.

No. of Sec.	Distance in feet.	Total Quantities. Cubic Yards. Earth Ex'tion.	Rock Ex'tion.	Emban k't.	Prot'on Wall.	Quantities Estimated. Earth Ex'tion.	Rock Ex'tion.	Embank't.	Prot'on Wall.	Prices. E'h	R'k.	Embk't	Pro W.	Clearing and Grub'g.	Amount	Mechanical Work.	Total Amount of Sections.
1	6.264	12.000	48,500	65,000	8,800	12,000	48,500		8,800	16	65		75	100	40,145	2,225	42,370
2	6,912	106.000		62,000	9,000	106,000			9,000	20			125	50	32,500	2,725	35,225
3	5.616	23.500	15,300	20,000	3,600	23,500	15,300		3.600	16	65		125	50	18,255	1,115	19,370
4	9.540	10,300	7,000	78,000	12,500	103,000	7.000		12.500	15	60		100	150	32,300	1,650	33,950
5	11,232	152.000	108,000	115.000	15.600	100.000	108,000		15,600	20	75		50	100	108,900	7,110	116,010
6	7,560	35,500	22.000	70,000	9,600	35,500	22,000	20,000	9.600	16	70	16	60	100	30,140	1,850	31,990
7	7.560		29.000	96.000	13.700		29,000	70,000	13.700		70	16	60	50	39,770	4,375	44,145
8	7,776		79.000	59,000	8,700		79.000		8.700		75		60	100	64,570	1,580	66,150
9	6.264	12.000	29,000	74,000	8,800	12,000	29,000	37,000	8.800	15	75	18	60	50	35,540	2,925	38.465
10	6.912	86.600	35,000	81.000	2.500	86,600	35,000		2,500	18	80		100		46,088	6,780	52,868
11	9.288	4.500	39,500	140,000	3.400	4,500	39,500	90.000	3.400	15	75	20	60	200	50,540	10,324	60,864
12	7.344		55,000	132.000	10,500		55.000	60,000	10.500		70	20	60	150	56,950	3,150	60,100
13	6.372		29,000	75,000	12.800		29.000	40.00	12,800		70	20	60	50	36,030	3,125	39,155
14	7,560		30.600	43.000	9.100		30,600	5,000	9.100		75	20	50	100	28,600	3,175	31,775
15	5.562	4.800	32,000	18.400	6.200	4.800	32,000		6.200	15	70		60	100	26,940	1,750	28,690
16	7.668	16.000	18,500	23.500	3,800	16,000	18,500		3,800	15	70		60	200	17,830	1,200	19,030
17	11,286	32.600	19,200	54.000	2,500	32,600	19.200		2.500	25	75		100	100	25,150	2,800	27,950
18	8,208	44,000	10,000	110.500	4,800	44.000	10,000	56,000	4.800	25	75	20	100	50	34,550	4,000	38,550
19	6.480	46.000	8.200	112,000	8 300	46,000	8.200	57,000	8.300	18	75	18	·60		29,670	2,000	31,670
20	8.424	17.200	44,600	59,000	14.800	17.200	44,600		14,800	17	65		50	150	39,464	4,550	44,014
21	6.480	3.600	20,800	51.000	11,700	3,600	20.800	24.000	11,700	15	65	18	50	250	24,480	1,600	26,080
22	10.368	6,100	33,300	95,000	19,500	6.100	33.300	50,000	19,500	15	65	18	50	200	41,510	4,400	45,910
23	9,936	60,000	42,800	66.500	13.800	60,000	42.800		13,800	16	70		50	250	46,710	5,550	52,260
24	7,992	112.000	17,800	105.000	8.200	112.000	17,800		8,200	20	70		50		38,960	5,425	44,385
25	11.070	136,800	26.000	161.000	17,800	136,800	26,000		17,800	20	70		60	200	56,440	6,600	63,040
	199.674	1,014,200	800,100	1.965.900	240,000	962,200	800.100	509.000	240,000					2,750	1,002,032	91,984	1,094,016
	238,878	1,260,684	317.155	1.834.425	211.538	1.260,700	317,500	603,600	210,940					4,400	846,428	138,715	985,143
	438.552	2.274.884	1.117,255	3 800.325	451.538	2.222.900	1,117,600	1,112.600	450,940					7,150	1,848,460	230,699	2,079,159

Fencing 82,200

For Extending Wharves 30,000

Total $2,191,359

Summaryof Quantities andAmounts of Northern Division.

RIVER ROUTE.

No. of Sec.	Distance in feet.	Total quanties cubic yards. Earth Ex'tion.	Rock Ex'tion.	Em-bank't.	Prot'on Wall.	Quantities Estimated.. Earth Ex'tion.	Rock Ex'tion.	Em-bank't.	Prot'on Wall.	Prices. E'h.	R'k	Em-bk't	Pro. W.	Clear'g and Grub'g.	Amount	Mechanical Work.	Total Amount of Sections.
1	10,746	66,300	2.800	32.125		66.300	2 800			20	50			100	14.760	4.461	19,221
2	9.558	8,000	2,600	104.000		8 000	2,600	95.000		15	50	15		100	16.850	4.977	21.827
3	9,504	69,400		105,000	8.600	69.400		35.000	8,000	20		15	100	100	27.230	5.085	32,315
4	8.424	95,000		111.000	9 000	95,000		16 000	9.000	20		15	100	100	30.500	6.092	36,592
5	12.096	40.600		148.000	3 500	40.600		108.000	3.500	18		17	125	100	30.143	6.266	36.409
6	8.640	46,700		70.500		46.700		25 000		15		15		100	10.855	7 825	18,680
7	7.992	35,700	{ 1,800 { 6,400	85,500	7,500	35 700	{ 1.800 { 6,400	40.000	7.500	15	{ 75 { 60	18	100	100	25.345	6 250	31,595
8	9720		33.800	82,300	7.900		33.800	{ 14.606 { 17 0..	7.900		60	{ 25 { 18	50	200	31.140	3 882	35,022
9	10,152	135,000		90.000	938	135.000			940	16			125	250	23.025	5.401	28,426
10	7,776	68,000		60.000	7.100	68 000			7.100	15			125	300	20.375	3.200	23.575
11	9,936	65,000	4.000	79.000	7 000	65.000	4.000	20.000	7.000	16	60	12	125	250	24,200	3.395	27,595
12	8.208	28,000		33.000	100	28 000		8,000	100	15		12	100	100	5.360	4.311	9,671
13	11.232	24 , 4	42.155	93.500	16 000	24 500	42.500	10 000	16.000	16	80	20	50		90.270	10.300	100,570
14	20.730			180.000	30 000			180,000	30 000			22	125		77.100	7.665	84.765
15	3.384	30,000				30 000				18					65.400	15.075	80,475
16	8.532	130,000		71.000	11 000	130.000			11,000	20			125	300	40.050	2.225	42.275
17	12.960	151,000		51.500	6 500	151.000			6 500	15			125	300	31.075	3.740	34,815
18	7.344	94,000	23,000	35,000	8.600	94.000	23.000		8 600	13	50		125	300	34.770	4.905	39,675
19	12.312	53,500	48.800	88.000	18 000	53 500	48.800		18 000	15	70		75	400	56.085	7.215	63,300
20	9.072		44.200	72.000	15.000		44.200	10,000	15.000		70	17	60	250	41.890	4.595	46.485
21	11.880		34.500	57.500	13.700		34 500	12,000	13.700		65	14	60	400	32.725	7.125	39,850
22	8,316		30.000	43.500	11.300		30.000	5.000	11.300		70	15	65	200	29.295	3.275	32,570
23	10.476		42.100	51.000	13.700		42.100	8.000	13.700		70	15	70	400	40.660	5.350	46.010
24	9.882	120,000	1.000	91.000	16.100	120 000	1.000		16.100	22	75		125	50	47.325	6.100	53,425
	238.878	1,260,684	317,155	1,834.425	211.538	1.260.700	317.500	603.600	210.940					4.400	846.428	138,715	985.143
	199.674	1,014.200	800.100	1.965.900	240.000	962.200	800.100	509.000	240.000					2.750	1.002 032	91.984	1,094,016
	438.552	2.274,884	1,117,255	3,800.325	451 538	2.222.900	1,117,600	1.112,600	450.940					7.150	1.848 460	230.699	2.079.159

Fencing.................................. 82.200

For Extending Wharves.................. 30.000

Total................ $2.191,359

Summary of Quantities and Amounts of Southern Division.

INTERIOR ROUTE.

No. of Sec.	Dist'nce in feet.	Total Quantities. Cubic Yards. Earth Exca'n.	Rock Exca'n.	Em-bank't.	Prot'on Wall.	Quantities Estimated. Earth Exca'n.	Rock Exca'n.	Em-bank't.	Prot'on Wall.	Prices. E'h	R'k	Em-bk't	Pro. W.	Cleari'g and Grub'g.	Amount	Mech'l Work.	Total Amou't of Sections.
1	6.264	12.000	48.500	65,000	8.800	12.000	48,500		8,800	16	65		75	100	40,145	2,225	42,370
2	6,912	106,000		62.000	9.000	106.000			9.000	20			125	50	32,500	2,725	35,225
3	5.616	23,500	15 300	20,000	3.600	23.500	15.300		3,600	16	65		125	50	18,255	1,115	19,370
4	9.540	103,000	7.000	78.000	12.500	103.000	7,000		12,500	15	60		100	150	2,300	1,650	33,950
5	12.558	67.000	78,000	319.000	11.000	67,000	78,000	170,000	11,000	15	75	18	50	100	5,420	9,952	115,372
6	108.000	279.000	37 000	294.000		279,000	37,000			17	80				77,030	10,467	87,497
7	9,774	102.000	4 000	66 000		102,000	4.000			18	80			50	21,610	4,340	25,950
8	7.830	21.000	8 000	107.000		21,000	8,000	76,000		16	80	14		150	20,550	4,664	25,214
9	7.992	17.000	17.000	78.000		17,000	17.000	44.000		17	80	15		100	23,190	9,704	32,894
10	10.718	52.500	8.000	187.600		52.500	8,000	127.000		22	80	15			37,000	10,559	47,559
11	13.176	38.500	51 300	239.300		38.500	51,300	138,000		16	80	14			66,520	10,829	77,349
12	9.072	28.200	12 400	31.600		28.200	12.400			15	65			100	12,390	6,260	18,650
13	7.344	12 500	12.700	58.200		12.500	12,700	30.000		15	80	15		50	16,585	2,828	19,413
14	8.424	17.000	13.200	85.600		17,000	13,200	54,000		18	75	16		100	21,700	4,538	26,238
15	7,344	11.600	17.000	211,600		11.600	17,000	180,000		16	75	15		50	41,656	6,324	47,980
16	6.696	43.500		81.200		43.500		38,000		16		14		50	12,330	5,213	17,543
17	9,288	31.200	600	58.000		31,200	600	28.000		18	75	14		50	10,036	2,770	12,806
18	9.504	58.000		35 000		58,000				15				50	8,750	4,990	13,740
19	9.720	22.000	16.000	49.300		22,000	16,000	8.000		15	75	14		100	16,520	3,130	19,650
20	6.480	20,500	7.200	29.000		20.500	7,200	3,000		20	75	12		100	9,960	5,640	15,600
21	5,832	53,400	2,200	45.900		53,400	2.200			20	75			100	12,430	3,630	16,060
22	9,555	53,800		59,300		53,800		8,000		18		12			10,644	8,390	19,034
	190.439	1,173,200	355,400	2.260.600	44.900	1,173.200	355.400	904,000	44,900					1,500	647,521	121,943	769,464
	243.696	2,213,200	18,600	3,831.500		2,213.200	18,600	1,726,000						5,050	583,175	263,828	847,001
	434,135	3.386,400	374,000	6,092,100	44.900	3,386,400	374,000	2,630,000	44,900					6,550	1,230,696	385,771	1,616,465
										Fencing							85.200
																	$1,701,665

Summary of Quantities and Amounts of Northern Division.

INTERIOR ROUTE.

No. of Sec.	Dist'nce in feet.	Total Quantities. Cubic Yards. Earth Ex'tion.	Rock Ex'tion.	Em-bank't.	Prot'on Wall.	Quantities Estimated. Earth Ex'tion.	Rock Ex'tion.	Em-bank't.	Prot'on Wall.	Prices. E'h	R'k	Em-bkt.	Pro. W.	Clear'g and Grub'g.	Amount	Mech'l Work.	Total Amount of Sections.
1	8,964	4.600		178.000		4,600		173,000		15		16		200	28,580	5,975	34,555
2	7.236	57.000		155,000		57.000		98,000		15		16		100	24,330	4,671	29,001
3	8.856	485.000		619,000		485.000		134.000		14		12		500	84,480	23,585	108,065
4	10,152	270,000		564.000		270,000		294,000		14		12		500	73,580	21,796	95,376
5	11,124	283.000		565.000		283.000		282,000		14		12		500	73,960	33,451	107,411
6	14,364	217,000		466 000		217,000		149,000		15		13		300	52,220	26,200	78,420
7	6.912	38.500		21.000		38,000				18				50	6,980	2,571	9,551
8	8.856	37,000		26.000		37.000				16				100	6,020	3,290	9,310
9	11.664	29.000		56,000		29,000		30,000		15		14		200	8,750	7,928	16,678
10	9.720	24.500		78,000		24,500		55,000		15		15		200	12,125	5,662	17,785
11	7.992	24.000		76.000		24.000		60,000		15		15		50	12,650	21,828	34,478
12	9.072	19 500		5.000		19,500		5.000		12		12		200	3,140		3,140
13	11.880	72.000		314.000		72,000		242,000		22		14		300	50,020	15,453	65,473
14	10,152	86.000		67.000		86.000				15				100	13,000	30,153	43,153
15	11.016	47.500		73.000		47.500		26,000		16		12		100	10,820	2,781	13,601
16	3.990	28.500		82.500		28,500		56.000		16		14			12,400	6,182	18,582
17	11.988	83.600		66.000		83.600				16				50	13,426	3,824	17,250
18	8,100	85.300	600	70.500		85.300	600	17,000		13	75	13		100	13,849	5,193	19,042
19	8.316	65.000	6,000	57.500		26.000 / 39.000	6,000	5,000		12 / 20	80	12		300	17,400	3,708	21,108
20	10.584	43.300	1,500	41,500		43.300	1,500	10.000		13	100	12		200	8,529	5,020	13,549
21	11.556	49,000		62.000		49,000		24.000		15		12		100	10,330	6,860	17,190
22	7.020	52.000	5,000	109,000		52,000	5.000	54,000		17	100	14			21,400	14,344	35,744
23	11.448	33.600	2.000	17.500		17.500 / 16.100	2.000			18 / 12	100			400	7,482	2,875	10,357
24	10,152	9.300	3.500	25.000		9,300	3,500	12,000		18	100	14		200	7,054	4,424	11,478
25	12 582	69,000		37,000		69,000				15				300	10,650	6,054	16,704
	243.696	2.213,200	18,600	3,831.500	44,900	2.213.200	18,600	1,726,000	44,900					5,050	583,175	263,828	847,001
	190.439	1,173,200	355,400	2,260.600		1,173,200	355,400	904,000						1,500	647,501	121,943	769,464
	434.135	3,386,400	374.000	6.092.100	44,900	3,386.400	374.000	2,630,000	44,900					6.550	1,230,676	385,771	1,616,465

Fencing... 85,200

Total........... $1,701,665